SAMSUNG SECRET

SAMSUNG ELECTRONICS

Product Information

Customer : Voxson   DATE : June 15, 2010

SAMSUNG TFT-LCD

MODEL : LTA216AT01

The Information Described in this Specification is Preliminary and can be changed without prior notice

NOTE :

LCD Business

Samsung Electronics Co . , LTD.

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	1 / 24

SAMSUNG SECRET

Contents

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	2 / 24

General Description

Description

LTA216AT01 is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT(Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit. The resolution of a 21.6" is 1366 x 768 and this model can display up to 16.7 million colors with wide viewing angle of 80° or higher in all directions. This panel is intended to support applications to provide a excellent performance for Flat Panel Display such as Home-alone Multimedia TFT-LCD TV and High Definition TV.

Features

- RoHS compliance (Pb-free)
- High contrast & aperture ratio with wide color gamut
- TN(Twisted Nematic) mode
- Wide viewing angle
- High speed response
- HD resolution (16:9)
- Low Power consumption
- 4 CCFLs (Cold Cathode Fluorescent Lamp)
- DE (Data Enable) mode
- LVDS (Low Voltage Differential Signaling) interface (1pixel/clock)

General Information

Items	Specification	Unit	Note
Module Size	501.0(H) x 297.0(V) x 16.6(D)	mm	±0.5mm
Weight	2,300 (Max)	g	
Pixel Pitch	0. 349(H) x 0.349(V)	mm	
Active Display Area	477.4(H) x 268.4(V)	mm	21.6"
Surface Treatment	Hard-Coating (3H)		Anti-glare
Display Colors	6 bit + FRC - 16.7M	colors	
Number of Pixels	1366 x 768	pixel	
Pixel Arrangement	RGB vertical stripe		
Display Mode	Normally White		
Luminance of White	350 (Typ.)	cd/m^2	

SAMSUNG SECRET

1. Absolute Maximum Ratings

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	GND-0.5	6.0	V	(1)
Storage temperature	T_{STG}	-20	60	℃	(2)
Center of Glass Surface temperature (Operation)	T_{SUR}	0	50	℃	(2)
Operation temperature	T_{OPR}	0	50	℃	(2)
Shock (non - operating)	S_{nop}	-	50	G	(3)
Vibration (non - operating)	V_{nop}	-	1.5	G	(4)

Note (1) Ta= 25 ± 2 ˚C
(2) Temperature and relative humidity range are shown in the figure below.
  a. 90 % RH Max. (Ta ≤ 39 ˚C)
  b. Relative Humidity is 90% or less. (Ta > 39 ˚C)
  c. No condensation
(3) 11ms, sine wave, one time for ±X, ±Y, ±Z axis
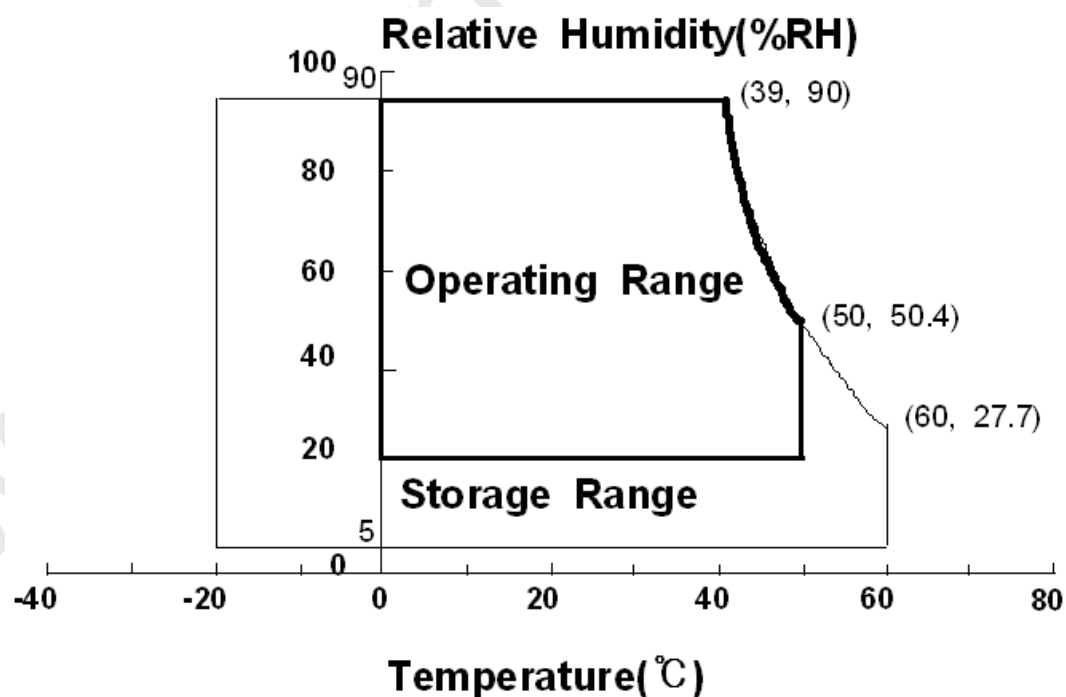(4) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis

Fig. Temperature and Relative humidity range

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	4 / 24

2. Optical Characteristics

SAMSUNG SECRET

The optical characteristics should be measured in a dark room or equivalent.
Measuring equipment : TOPCON RD-80S, TOPCON SR-3,ELDIM EZ-CONTRAST

(Ta = 25 $\pm$ 2°C, VDD=5.0V,   fv= 60Hz, f_{DCLK}=72.33 MHz, I_L = 7.5mA)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R	Normal θL,R=0 θU,D=0 Viewing Angle	600	800	-		(1) SR-3
Response Time	On/off	Tr+Tf		-	5	8	msec	(3) RD-80S
Luminance of White (Center of screen)		Y_L		300	350	-	cd/m²	(4) SR-3
Color Chromaticity (CIE 1931)	Red	Rx		TYP. -0.03	0.635	TYP. +0.03		(5),(6) SR-3
		Ry			0.335			
	Green	Gx			0.285			
		Gy			0.608			
	Blue	Bx			0.146			
		By			0.062			
	White	Wx			0.285			
		Wy			0.293			
Color Gamut		-		-	72	-	%	(5) SR-3
Color Temperature		-		-	9000	-	K	(5) SR-3
Viewing Angle	Hor.	θL	C/R≥10	70	80	-	Degree	(6) EZ-Contrast
		θR		70	80	-		
	Ver.	θU		70	80	-		
		θD		70	80	-		
Brightness Uniformity (9 Points)		B_{uni}		-	-	25	%	(2) SR-3

- Test Equipment Setup
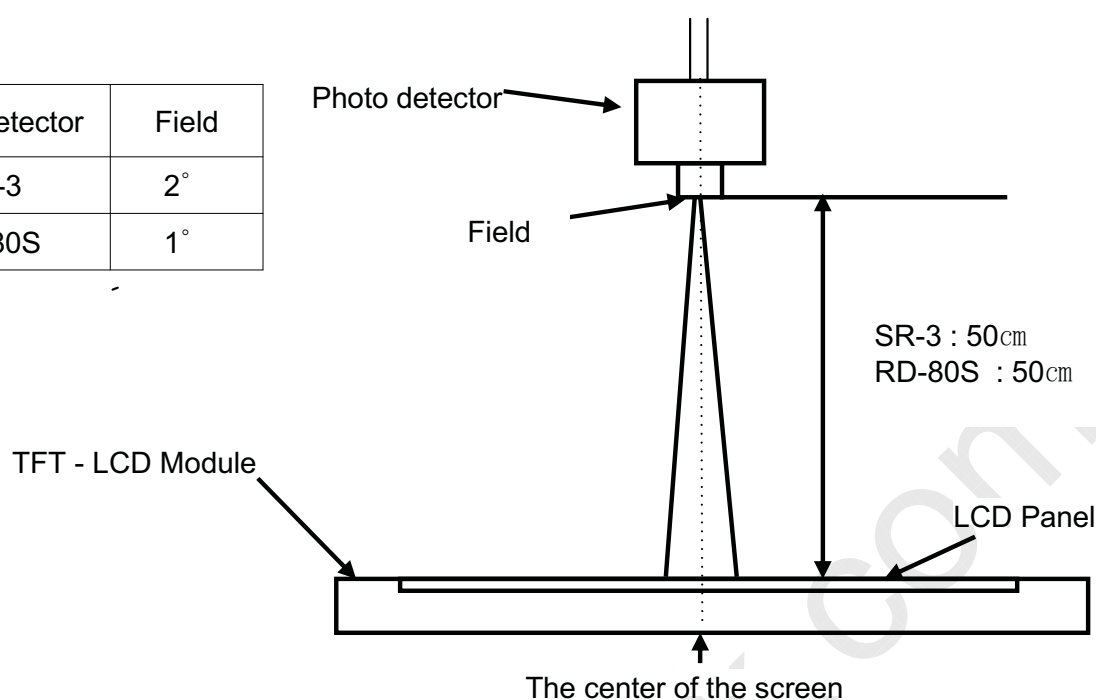
    The measurement should be executed in a stable, windless and dark room between 40min and 60min after lighting the back light at the given temperature for stabilization of the back light. This should be measured in the center of screen.

    Environment condition : Ta = 25 $\pm$ 2 °C

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	5 / 24

SAMSUNG SECRET

Photo detector	Field
SR-3	2°
RD-80S	1°

Photo detector

Field

SR-3 : 50㎝
RD-80S : 50㎝

TFT - LCD Module

LCD Panel

The center of the screen

- Definition of test point

	228	683	1138
128	⑨	⑧	⑦
384	⑥	⑤	④
640	③	②	①

Active Area

◯ Test Point
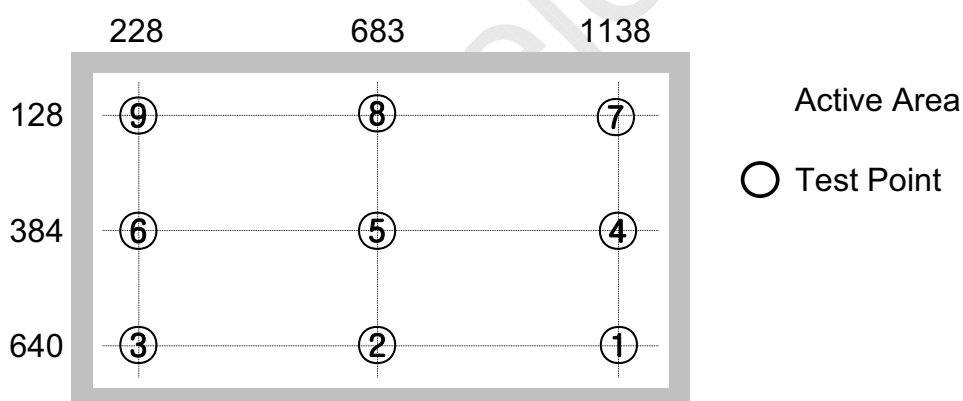
Note (1) Definition of Contrast Ratio (C/R)
       : Ratio of gray max (Gmax) & gray min (Gmin) at the center point ⑤ of the panel

$$C/R = \frac{G\max}{G\min}$$

     Gmax : Luminance with all pixels white
     Gmin : Luminance with all pixels black

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	6 / 24

SAMSUNG SECRET

Note (2) Definition of 9 points brightness uniformity (Test Pattern : Full White)

$$Buni = 100 * \frac{(B\max - B\min)}{B\max}$$

Bmax : Maximum brightness
Bmin : Minimum brightness

Note (3) Definition of Response time : Sum of Tr, Tf

| Display data | Black (data off) | White (data on) | Black (data off) |

Optical Instruments Response
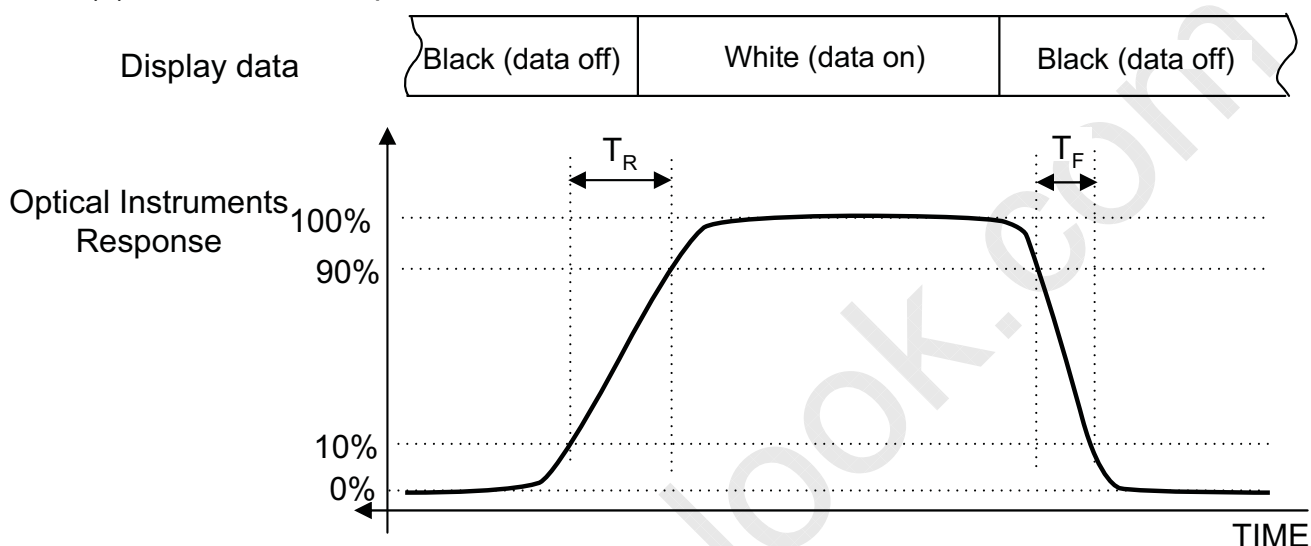
Note (4) Definition of Luminance of White : Luminance of white at center point ⑤

Note (5) Definition of Color Chromaticity (CIE 1931)
Color coordinate of Red, Green, Blue & White at center point ⑤

Note (6) Definition of Viewing Angle
: Viewing angle range (C/R ≥10)

| MODEL | LTA216AT01 [Voxson] | Doc. No | 06-000-G-091015 | Page | 7 / 24 |

SAMSUNG SECRET

3. Electrical Characteristics

3.1 TFT LCD Module

The connector for display data & timing signal should be connected.
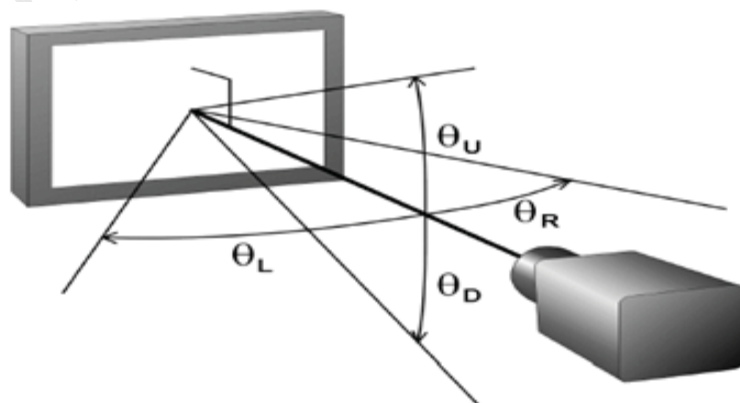
Ta = 25°C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	4.5	5.0	5.5	V	(1)
Current of Power Supply	(a) Black	I_{DD}	440	850	900	mA	(2),(3)
	(b) White		308	500	508	mA	
	(c) Dot-Pattern		655	900	950	mA	
Vsync Frequency		f_V	50	60	75	Hz	
Hsync Frequency		f_H	39.9	47.4	59.5	kHz	
Main Frequency		f_{DCLK}	59.75	72.33	90.5	MHz	
Rush Current		I_{RUSH}	-	-	5.0	A	(4)

Note (1) The ripple voltage should be controlled under 10% of V_{DD}.

(2) f_V=60Hz, f_{DCLK} = 72.33 MHz, V_{DD} = 5.0V, DC Current.

(3) Power dissipation check pattern (LCD Module only)

a) Black Pattern   b) White Pattern   c) Dot-Pattern
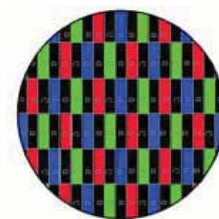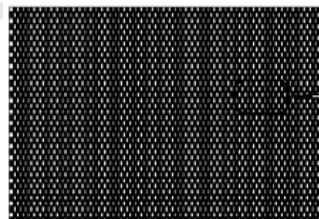
(4) Measurement Conditions

100% ------ V_{DD}
90%
10%
GND

T_{RUSH}=470μs
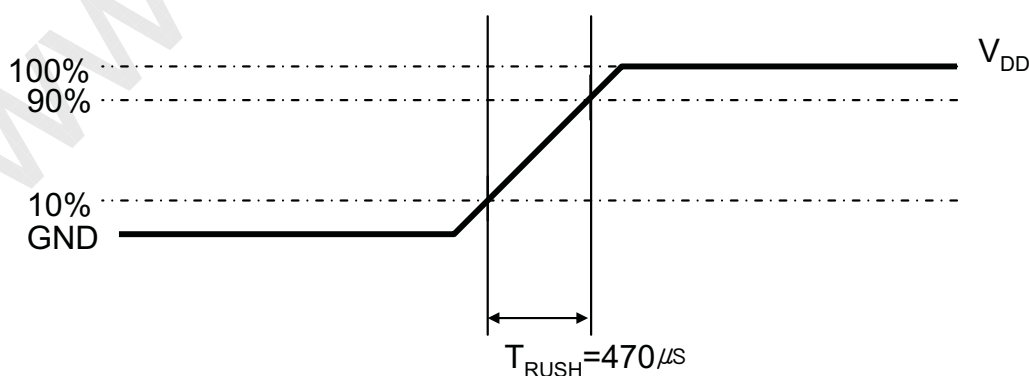
Rush Current I_{RUSH} can be measured when T_{RUSH}. is 470μs.

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	8 / 24

SAMSUNG SECRET

3.2 Back Light Unit

The back light unit is an edge - lighting type with 4 CCFLs (Cold Cathode

Fluorescent Lamps) The characteristics of two dual lamps are shown in the following tables.

Ta=25 $\pm$ 2°C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	I_L	4.0	7.5	8.0	mArms	(1)
Lamp Voltage	V_L	725	805	886	Vrms	
Lamp Frequency	f_L	40	-	80	kHz	(2)
Operating Life Time	Hr	50,000	-	-	Hour	(3)
Startup Voltage	Vs	-	-	0°C : 1,750 / 25°C: 1,430	Vrms	(4)

Note (1) Specified values are for a single lamp.

Lamp current is measured with current meter for high frequency as shown below.

Refer to the following block diagram of the back light unit for more information.
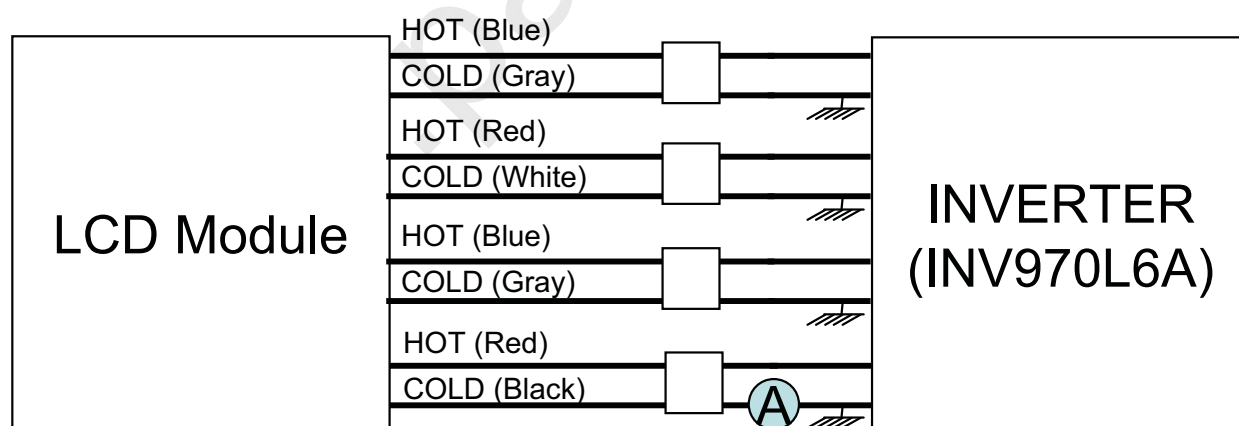
Fig. Measurement point of Lamp Current

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	9 / 24

(2) Lamp frequency which may produce interference with horizontal synchronous frequency may cause line flow on the display. Therefore lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

(3) Life time (Hr) is defined as the time when brightness of a lamp unit itself becomes 50% or less than its original value at the condition of Ta = $25\pm2°C$ and I_L = 7.5 mArms

(4) If an inverter has shutdown function, it should keep its output for over 1 second even if the lamp connector is open. Otherwise the lamps may not be turned on.

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	10 / 24

3.3 Back Light Unit Diagram

LAMP(CCEL) — 1 ← HOT (Blue)
2 ← COLD (Gray)

LAMP(CCEL) — 1 ← HOT (Red)
2 ← COLD (White)

LAMP(CCEL) — 1 ← HOT (Blue)
2 ← COLD (Gray)

LAMP(CCEL) — 3 ← HOT (Red)
4 ← COLD (Black)
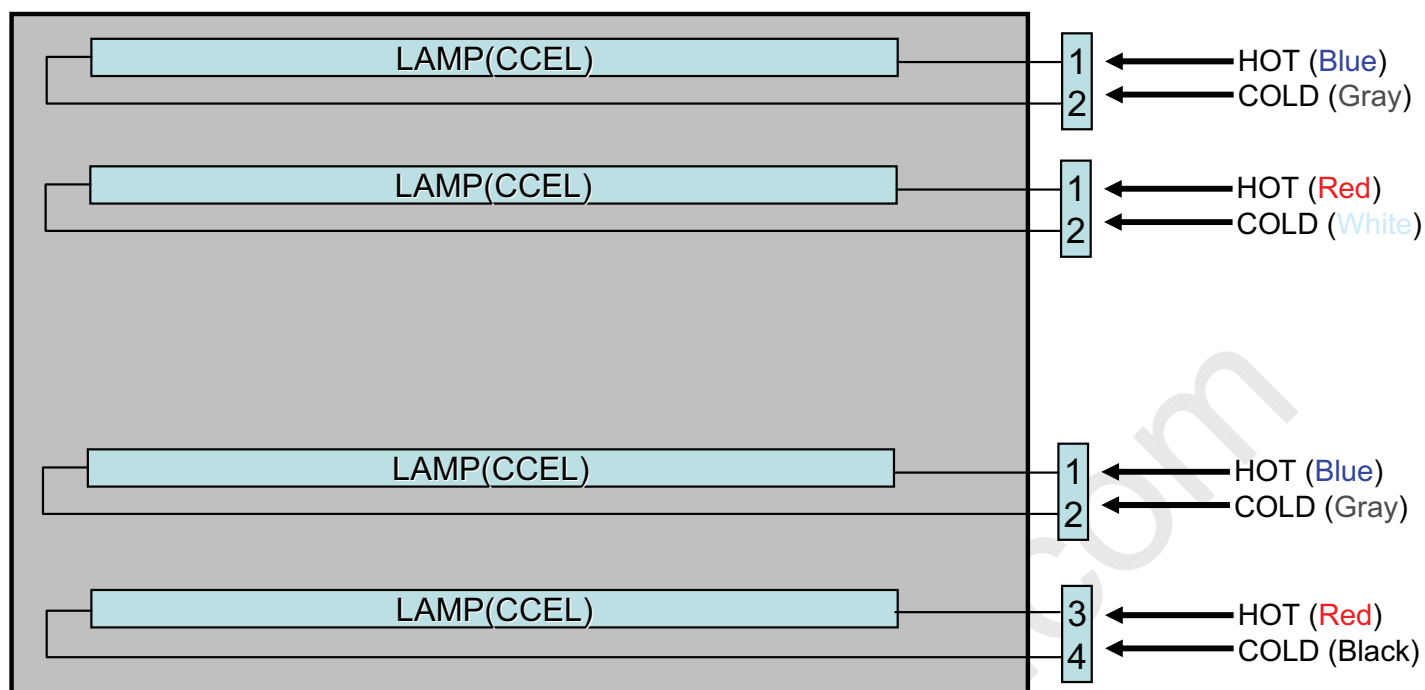
3.4 Back Light Unit Pin Assignment

	Pin No.	Input	Function
Upper	1, 3	Hot	High Voltage
	2, 4	Cold	Ground
Lower	1, 3	Hot	High Voltage
	2, 4	Cold	Ground
Connector Part No.	VH,35001HS-02		

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	11 / 24

4. Input Terminal Pin Assignment

4.1. Input Signal & Power (Connector : UJUELE, IS100-L30O-C23)

PIN NO	SYMBOL	FUNCTION
1	NC	No Connection
2	CE	No Connection
3	CTL	No Connection
4	GND	Power Ground
5	RXIN0-	Negative LVDS Differential Data Input (0)
6	RXIN0+	Positive LVDS Differential Data Input (0)
7	GND	Power Ground
8	RXIN1-	Negative LVDS Differential Data Input (1)
9	RXIN1+	Positive LVDS Differential Data Input (1)
10	GND	Power Ground
11	RXIN2-	Negative LVDS Differential Data Input (2)
12	RXIN2+	Positive LVDS Differential Data Input (2)
13	GND	Power Ground
14	RXCLKIN-	Negative LVDS Differential Clock Input (Clock)
15	RXCLKIN+	Positive LVDS Differential Clock Input (Clock)
16	GND	Power Ground
17	RXIN3-	Negative LVDS Differential Data Input (3)
18	RXIN3+	Positive LVDS Differential Data Input (3)
19	GND	Power Ground
20	NC	No Connection
21	NC	No Connection
22	NC	No Connection
23	GND	Power Ground
24	GND	Power Ground
25	GND	Power Ground
26	VCC	
27	VCC	
28	VCC	Power Supply : +5V
29	VCC	
30	VCC	

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	12 / 24

SAMSUNG SECRET

Note) Pin number starts from Left side

PCB ▼

Pin No. 1   Pin No. 30
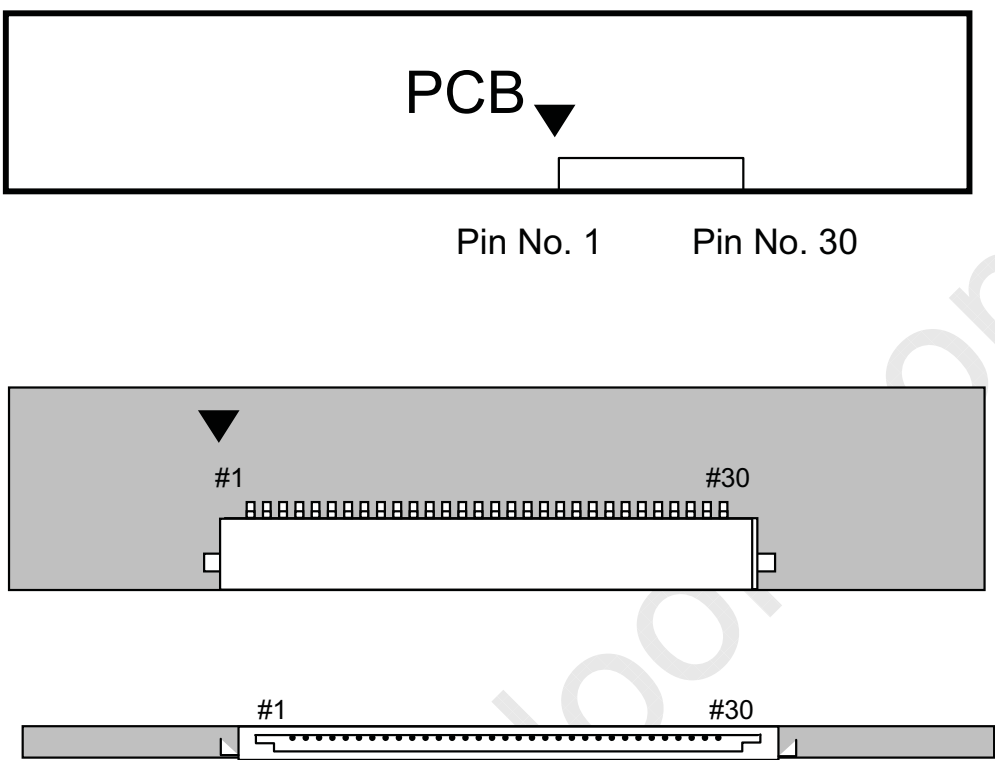
#1   #30

#1   #30

Fig. Connector diagram

a. All GND pins should be connected together and also be connected to the
LCD's metal chassis.

b. All power input pins should be connected together.

c. All NC pins should be separated from other signal or power.

| MODEL | LTA216AT01 [Voxson] | Doc. No | 06-000-G-091015 | Page | 13 / 24 |

SAMSUNG SECRET

4.2 LVDS Interface

	LVDS pin	DATA Format (VESA)
TxOUT/RxIN0	TxIN/RxOUT0	R0
	TxIN/RxOUT1	R1
	TxIN/RxOUT2	R2
	TxIN/RxOUT3	R3
	TxIN/RxOUT4	R4
	TxIN/RxOUT6	R5
	TxIN/RxOUT7	G0
TxOUT/RxIN1	TxIN/RxOUT8	G1
	TxIN/RxOUT9	G2
	TxIN/RxOUT12	G3
	TxIN/RxOUT13	G4
	TxIN/RxOUT14	G5
	TxIN/RxOUT15	B0
	TxIN/RxOUT18	B1
TxOUT/RxIN2	TxIN/RxOUT19	B2
	TxIN/RxOUT20	B3
	TxIN/RxOUT21	B4
	TxIN/RxOUT22	B5
	TxIN/RxOUT24	HSYNC
	TxIN/RxOUT25	VSYNC
	TxIN/RxOUT26	DEN
TxOUT/RxIN3	TxIN/RxOUT27	R6
	TxIN/RxOUT5	R7
	TxIN/RxOUT10	G6
	TxIN/RxOUT11	G7
	TxIN/RxOUT16	B6
	TxIN/RxOUT17	B7
	TxIN/RxOUT23	RESERVED

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	14 / 24

SAMSUNG SECRET

4.3 Input Signals, Basic Display Colors and Gray Scale of Each Color

COLOR	DISPLAY (8bit)	R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7	GRAY SCALE LEVEL
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK ↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~ R252
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	LIGHT	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R255
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK ↑	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~ G252
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	LIGHT	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G253
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G254
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G255
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	B2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~ B252
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B253
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B254
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B255

Note (1) Definition of Gray :

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	15 / 24

SAMSUNG SECRET

5. Interface Timing

5.1 Timing Parameters (DE only mode)

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	NOTE
Clock	Frequency	$1/T_C$	59.75	72.33	90.50	MHz	-
Hsync		F_H	39.9	47.4	59.5	KHz	-
Vsync		F_V	50	60	75	Hz	-
Vertical Display Term	Active Display Period	T_{VD}	-	768	-	lines	-
	Vertical Total	T_{VB}	773	790	1414	lines	-
Horizontal Display Term	Active Display Period	T_{HD}	-	1366	-	clocks	-
	Horizontal Total	T_H	1440	1526	1744	clocks	-

Note (1) This product is DE only mode. The input of Hsync & Vsync signal does

      not have an effect on normal operation.

    (2) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system

    (3) Internal Vcc = 3.3V

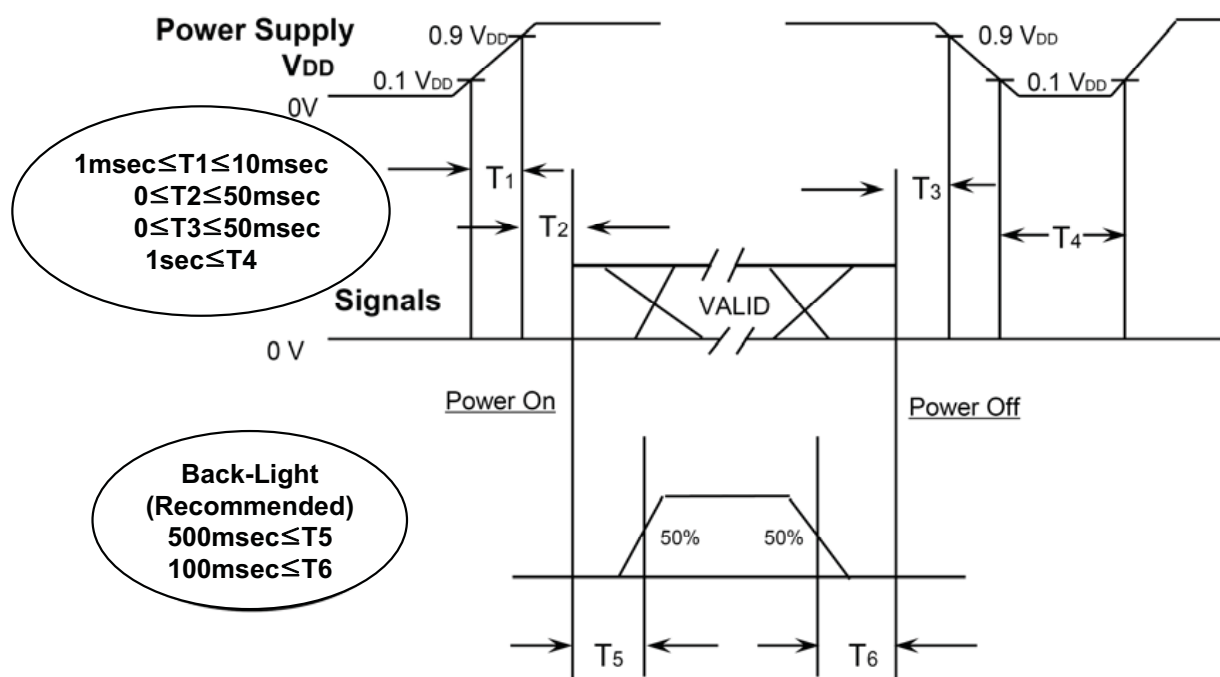| MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	16 / 24

SAMSUNG SECRET

5.2 Timing diagrams of interface signal (DE only mode)
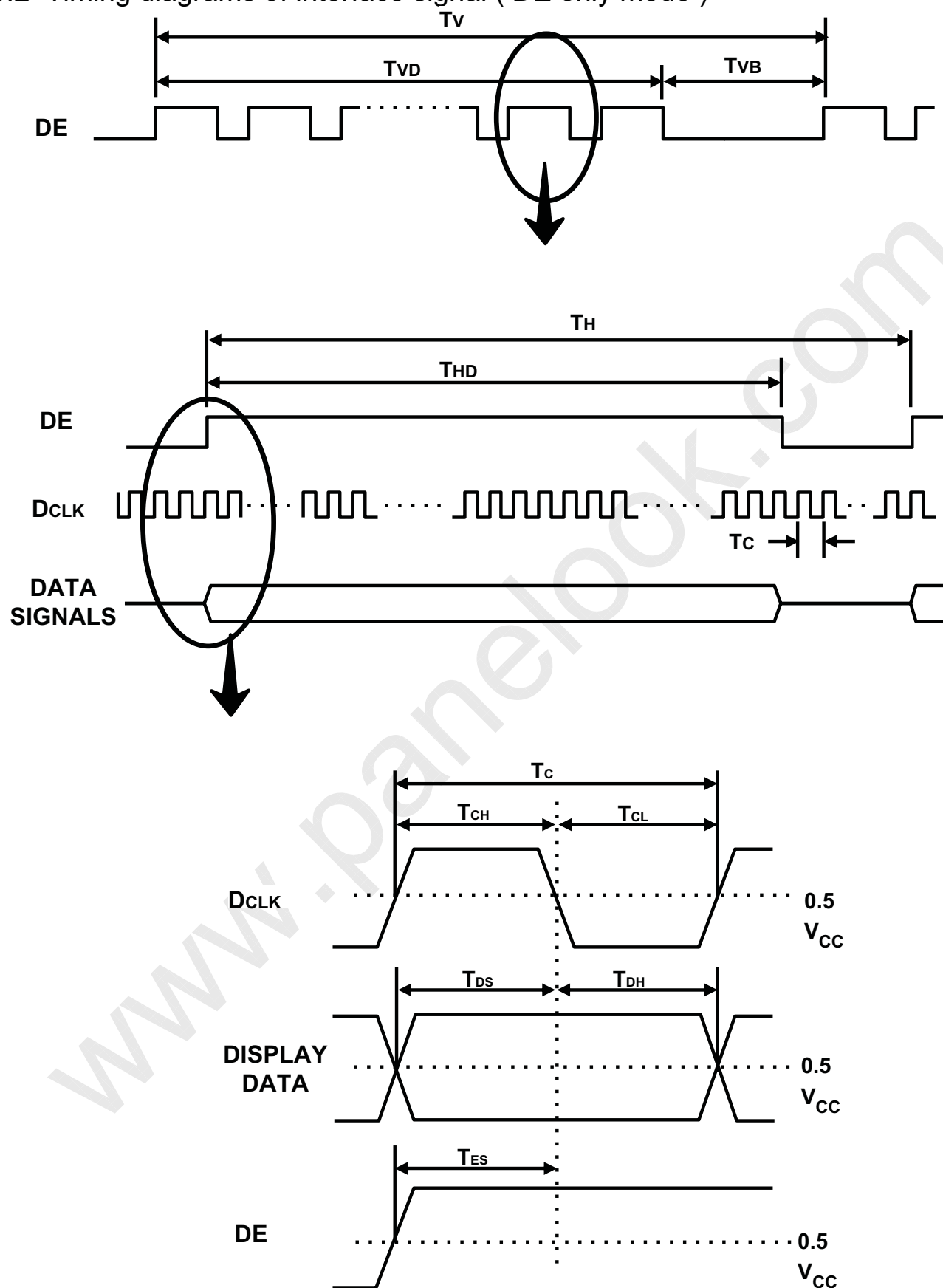
SAMSUNG SECRET

5.3 Power ON/OFF Sequence

   To prevent a latch-up or DC operation of the LCD Module, the power on/off
sequence should be as the diagram below.

T1 : V_{DD} rising time from 10% to 90%
T2 : The time from V_{DD} to valid data at power ON.
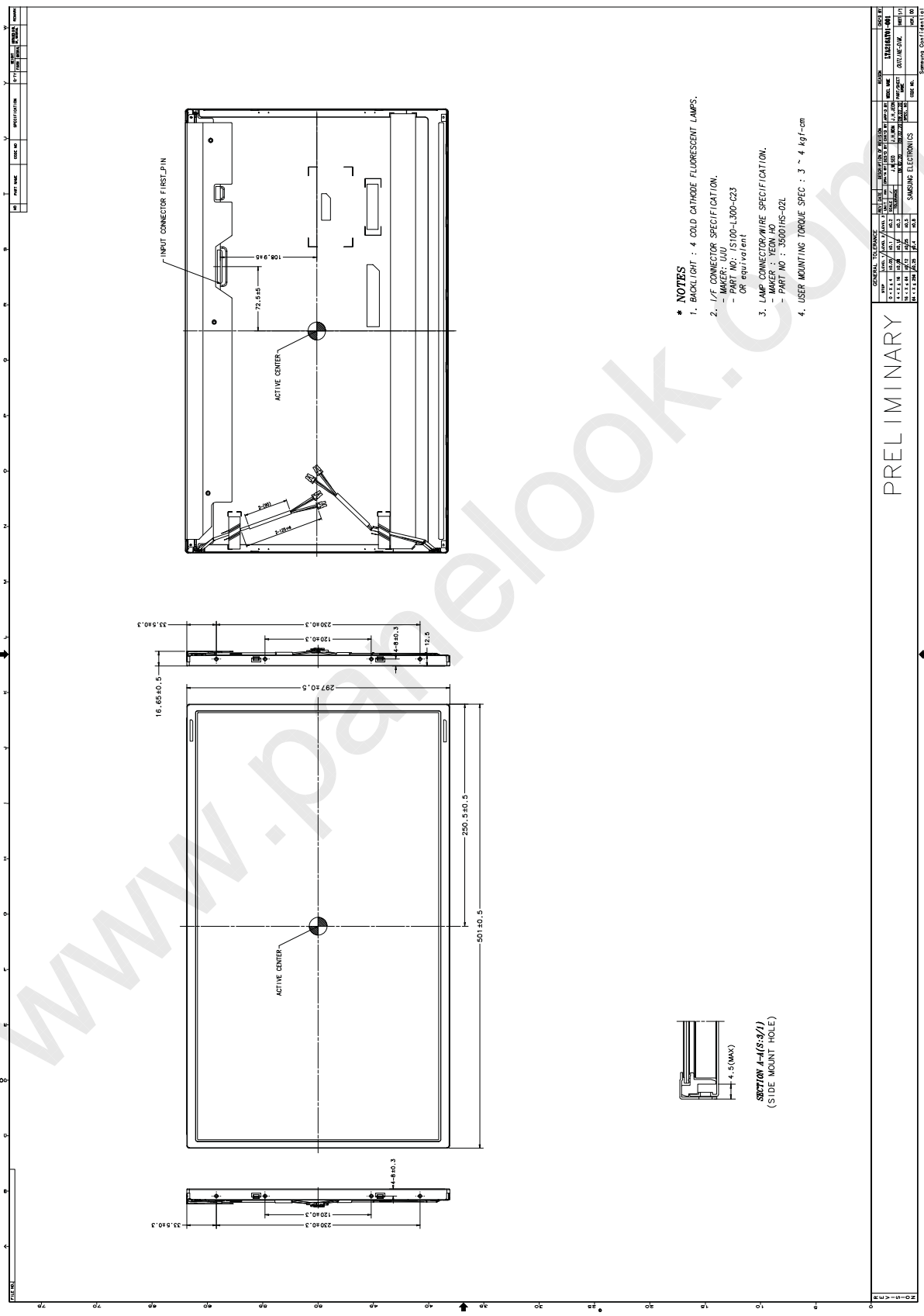T3 : The time from valid data off to V_{DD} off at power Off.
T4 : V_{DD} off time for Windows restart
T5 : The time from valid data to B/L enable at power ON.
T6 : The time from valid data off to B/L disable at power Off.

- The supply voltage of the external system for the Module input should be the same
  as the definition of V_{DD}.
- Apply the lamp voltage within the LCD operation range. When the back light turns on
  before the LCD operation or the LCD turns off before the back light turns off,
  the display may momentarily show abnormal screen.
- In case of V_{DD} = off level,
  please keep the level of input signals low or keep a high impedance.
- T4 should be measured after the Module has been fully discharged between power off
  and on period.
- Interface signal should not be kept at high impedance when the power is on.

| MODEL | LTA216AT01 [Voxson] | Doc. No | 06-000-G-091015 | Page | 18 / 24 |

6. Outline Dimension

* *NOTES*
1. BACKLIGHT : 4 COLD CATHODE FLUORESCENT LAMPS.
2. I/F CONNECTOR SPECIFICATION.
   - MAKER: UJU
   - PART NO.: IS100-L300-C23
   OR equivalent
3. LAMP CONNECTOR/WIRE SPECIFICATION.
   - MAKER : YEON HO
   - PART NO : 35001HS-02L
4. USER MOUNTING TORQUE SPEC : 3 ~ 4 kgf-cm

PRELIMINARY

INPUT CONNECTOR FIRST PIN

ACTIVE CENTER

SECTION A-A(S:3/1)
(SIDE MOUNT HOLE)

MODEL	LTA216AT01	Doc. No	06-000-G-091015	Page	19/24

SAMSUNG SECRET

7. PACKING

7.1 CARTON (Internal Package)
(1) Packing Form
    Corrugated fiberboard box and corrugated cardboard as shock absorber
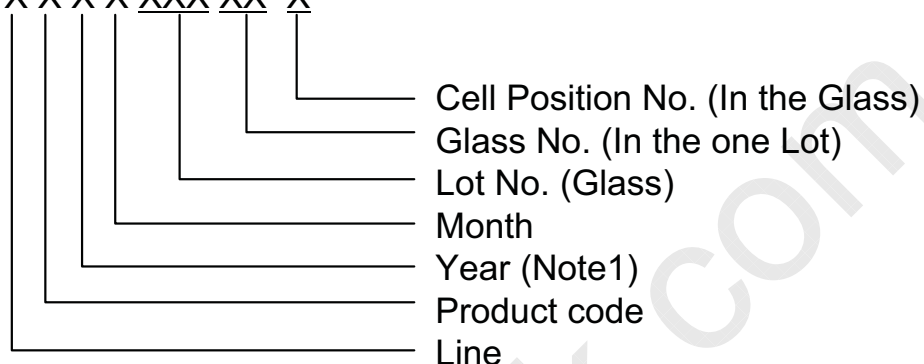(2) Packing Method

**Packing
-Pallet Box**

Cushion-Foam (Upper)

**LCD Module
(6EA)**

Cushion-Foam (Lower)

Pallet-Plastic
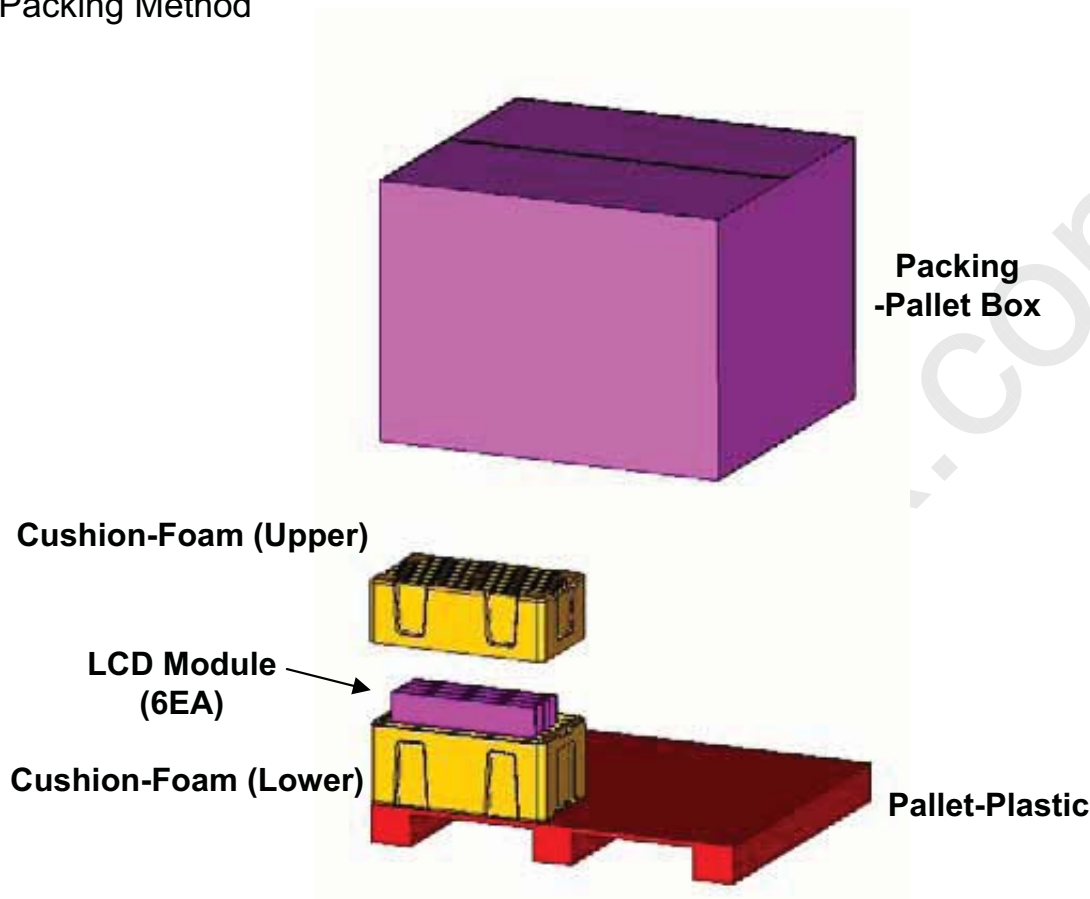
7.2 Packing Specification

Item	Specification	Remark
LCD Packing	72ea / (Packing -Pallet Box)	1. 2.3Kg / LCD (72ea) 2. 0.37Kg / Cushion-Foam (U:12ea, L:12ea) 3. 5.2Kg / Packing-Pallet Box (1ea) 4. Cushion-pallet Material : EPS 5. Packing-Pallet Box Material : DW4
Pallet	1Box / Pallet	1. Pallet weight = TBD kg
Packing Direction	Vertical	
Total Pallet Size	H x V x height	1130mm(H) x 965mm(V) x 696mm(height)
Total Pallet Weight	188.36kg	Pallet(7.0kg)+Module(2.3kg*72=165.6)+Cushion (up*12+botton*12=10.56kg)+Pallet-BOX (5.2kg)

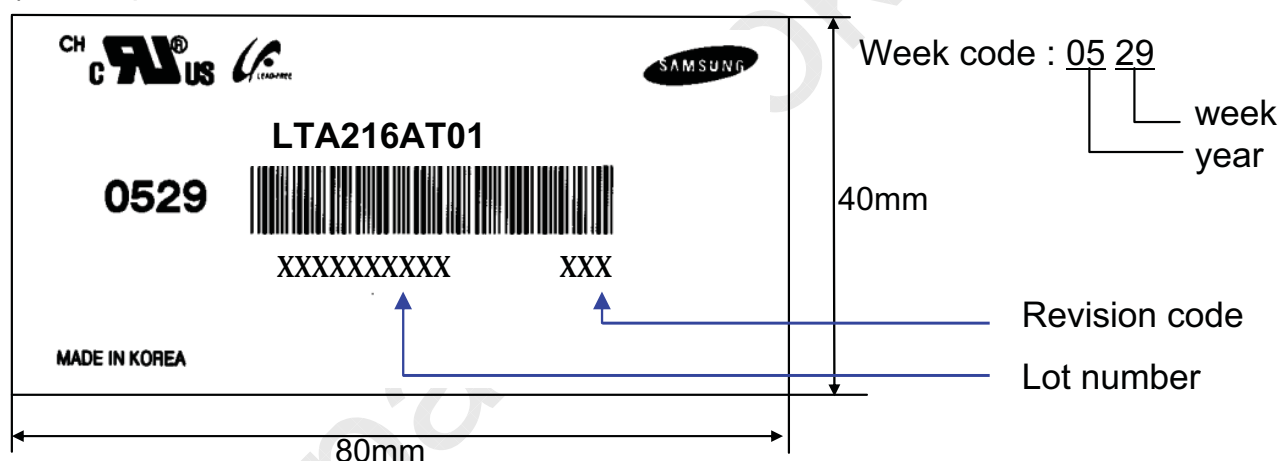| MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	20 / 24

SAMSUNG SECRET

8. MARKING & OTHERS

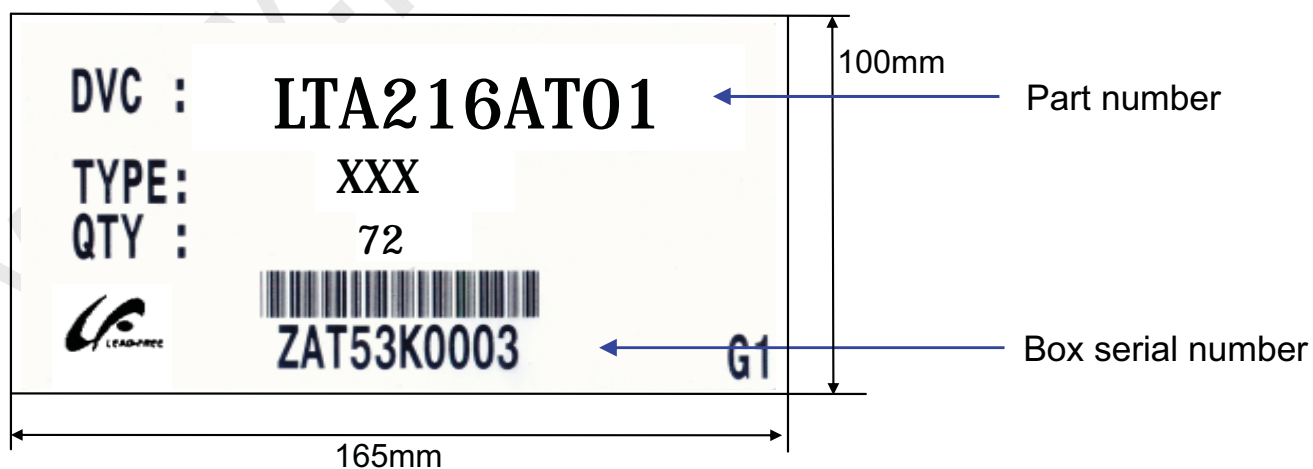A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1) Part number : LTA216AT01
(2) Revision: Three letters
(3) Lot number : X X X X XXX XX X

Cell Position No. (In the Glass)
Glass No. (In the one Lot)
Lot No. (Glass)
Month
Year (Note1)
Product code
Line

(4) Nameplate Indication

LTA216AT01

0529   XXXXXXXXXX   XXX

MADE IN KOREA

80mm

40mm

Week code : 05 29
week
year

Revision code

Lot number

(5) Packing box attach

DVC :   LTA216AT01
TYPE: XXX
QTY :   72
ZAT53K0003   G1

100mm

165mm

Part number

Box serial number

(6) Others
1. After service part
   Lamps cannot be replaced because of the narrow bezel structure.

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	21 / 24

9. General Precautions

9.1 Handling

(a) When the Module is assembled, it should be attached to the system firmly using all mounting holes. Be careful not to twist and bend the Module.

(b) Because the inverter use high voltage, it should be disconnected from power before it is assembled or disassembled.

(c) Refrain from strong mechanical shock and / or any force to the Module. In addition to damage, this may cause improper operation or damage to the Module and CCFT back light.

(d) Note that polarizers are very fragile and could be damage easily. Do not press or scratch the surface harder than a HB pencil lead.

(e) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining or discoloration may occur.

(f) If the surface of the polarizer is dirty, clean it using absorbent cotton or soft cloth.

(g) Desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(h) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away with soap thoroughly.

(i) Protect the Module from static, or the CMOS Gate Array IC would be damaged.

(j) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(k) Do not disassemble the Module.

(l) Do not pull or fold the lamp wire.

(m) Do not adjust the variable resistor located on the Module.

(n) Protection film for polarizer on the Module should be slowly peeled off just before use so that the electrostatic charge can be minimized.

(o) Pins of I/F connector should not be touched directly with bare hands.

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	22 / 24

9.2 Storage

(a) Do not leave the Module in high temperature, and high humidity for a long time.
It is highly recommended to store the Module with temperature from 0 to 35℃
and relative humidity of less than 70%.

(b) Do not store the TFT-LCD Module in direct sunlight.

(c) The Module should be stored in a dark place. It is prohibited to apply sunlight or
fluorescent light in storing.

9.3 Operation

(a) Do not connect or disconnect the Module in the "Power On" condition.

(b) Power supply should always be turned on/off by the "Power on/off sequence"

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic
interference should be done by system manufacturers. Grounding and shielding
methods may be important to minimize the interference.

(d) The cable between the back light connector and its inverter power supply should
be connected directly with a minimized length. A longer cable between
the back light and the inverter may cause lower luminance of lamp(CCFT) and
may require higher startup voltage(Vs).

9.4 Operation Condition Guide

(a) The LCD product should be operated under normal conditions.
Normal condition is defined as below;
- Temperature : 20±15℃
- Humidity : 55±20%
- Display pattern : continually changing pattern (Not stationary)

(b) If the product will be used in extreme conditions such as high temperature,
humidity, display patterns or operation time etc.., It is strongly recommended
to contact SEC for Application engineering advice. Otherwise, its reliability and
function may not be guaranteed. Extreme conditions are commonly found at
Airports, Transit Stations, Banks, Stock market, and Controlling systems.

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	23 / 24

9.5 Others

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)
Otherwise the Module may be damaged.

(d) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen.
To avoid image sticking, it is recommended to use a screen saver.

(e) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

(f) Please contact SEC in advance when you display the same pattern for a long time.

MODEL	LTA216AT01 [Voxson]	Doc. No	06-000-G-091015	Page	24 / 24